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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/752,541	12/29/2000	Stephen Boyd	4363P001	1435

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EXAMINER	
VU, TUAN A	
ART UNIT	**PAPER NUMBER**
2124	

DATE MAILED: 09/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/752,541	BOYD ET AL.	
	Examiner	Art Unit	
	Tuan A Vu	2124	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 June 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This action is responsive to the Applicant's response filed 6/11/2004.

As indicated in Applicant's response, no claims have been amended. Claims 1-22 are pending in the office action.

Claim 5 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shao-Po et al., "A Parser/Solver for Semidefinite Programs with Matrix Structure", Technical Report, Information System Laboratory, Stanford University, November 1995 (hereinafter Shao-Po – provided in IDS), in view of Hershenson et al., USPN: 6,311,145 (hereinafter Hershenson).

As per claim 1, Shao-Po discloses a parser program to parse mathematical optimization problems, where a optimization programming language (*spdsol* language – ch. 4.1.4, pg. 81) is converted from a set of algebraic expressions (e.g. eq. 4.1, pg. 79; eq. 4.2 pg. 80; eq. 4.3 – pg. 81) to a compact numeric format that can be accepted by a computer-based program solver (e.g. *matrix* 4.14 – pg. 87; *spdsol* language & equ. 4.15 – pg. 89).

But Shao-Po does not specify that the optimization program is a geometric program; nor does Shao-Po disclose converting a set of algebraic expressions to a numeric format that can be accepted by a geometric program solver. Shao-Po discloses parser/solver implemented method for optimizing of circuit design (ch. 4.1, pg. 79; Fig. 4.1 – pg. 87; Fig. 4.4, pg. 90) using a *sdpsol*

language programming (e.g. ch. 4.2.3 pg. 83-84). Hershenson, in a analogous method to Shao-Po's to optimize a real world problems implicating complex parametric constraints into a specific set of expressions, discloses optimizing complex non-linear circuit problems (e.g. induction or RF mathematics are non-linear just like Shao-Po's spring system – see Shao-Po: *differential equation* - equ *(4.11)* – pg. 86; section 4.4.1) and expressing the constraints or inequalities into posynomials, hence mostly non-linear using differential equations and submitting these to a solver using a geometric programming language (e.g. *Geometric program* - Fig. 1; *exponential* - col. 3, lines 32 to col. 4, line 12; col. 5, line 34 to col. 10, line 45). It would have been obvious for one of ordinary skill in the art at the time the invention was made to implement the math-based problem constraints as taught by Shao-Po into posynomial expressions as taught by Hershenson if available resources are such that Hershenson's geometric programming language can be implemented because this geometric programming technology operating upon convex or non-linear complex functions can be an efficient tool for effecting improved algorithms to solve problems like those non-linear complex inductive circuitry; and optimizing circuit designs as mentioned by Shao-Po, by solving constraints formed as posynomial, or sygnomials as claimed (see Hershenson, col. 1, 2).

As per claim 2, Shao-Po discloses an objective (eq. 4.1- pg. 79) and a set of constraints (e.g. *constraint lyap, constraint equ* – ch. 4.2.2 pg. 84).

As per claim 3, Shao-Po discloses one or more mathematical expressions (e.g. ch. 4.1, pg. 79; Fig. 4.1 – pg. 87; Fig. 4.4, pg. 90) and inequality (e.g. *Lyapunov inequality* – ch. 4.4.1, pg. 86).

As per claim 4, Shao-Po discloses optimization variables (*matrices, vector* – ch. 4.2.3 – pg. 83; *affine expressions*- ch. 4.2.1 pg. 82- Note: matrix or special expressions or structures used for the optimization process are optimization variables).

As per claim 5, Shao-Po discloses a computer-implemented method of parsing a mathematical optimization problem comprising:

reading a plurality of algebraic expressions that represent a mathematical problem, each algebraic expression in said plurality having one or more mathematical terms (e.g. *minimize* -, eq. 4.1, pg. 79; eq. 4.2 pg. 80; eq. 4.3 – pg. 81);

creating a set of mathematical expressions or constraints from the mathematical terms(e.g. *equality constraints* - ch. 4.3.1 pg. 85; *Lyapunov inequality* - ch. 4.4.1, pg. 86);

converting said set of constraints expressions to a optimized numeric format to be accepted by a computer-based program solver (e.g. *matrix* 4.14 – pg. 87; *spdsol* language & equ. 4.15 – pg. 89).

But Shao-Po does not specify that the mathematical terms or constraints are converted into a set of signomial expressions; nor does Shao-Po specify converting those set of signomial expressions into a compact numeric format accepted by the program solver. Shao-Po discloses parser/solver implemented method for optimizing of circuit design (ch. 4.1, pg. 79; Fig. 4.1 – pg. 87; Fig. 4.4, pg. 90) using a *sdpsol* language programming (e.g. ch. 4.2.3 pg. 83-84). Hershenson, in a analogous method to Shao-Po's to optimize a circuit design lumping parametric constraints into a specific set of expressions, discloses optimizing complex non-linear problems (e.g. induction or RF mathematics are non-linear as in Shao-Po's differential equation applying Lyapunov's case) and expressing the constraints or inequalities into posynomials and submitting

these to solver using a geometric programming language (e.g. Fig. 1; col. 5, line 34 to col. 10, line 45). It would have been obvious for one of ordinary skill in the art at the time the invention was made to implement the constraints as taught by Shao-Po into sygnomial expressions (Note: posynomial is interpreted as poly form of single sygnomial) as taught by Hershenson if the resources are such that Hershenson's geometric programming language can be implemented because this widely known programming technology operating upon convex or non-linear complex functions can be an efficient tool for effecting improved algorithms to solve problems like those non-linear complex inductive circuitry; and optimizing circuit designs as mentioned by Shao-Po, by solving constraints formed as posynomials, or set of sygnomials as claimed (see Hershenson, col. 1, 2).

As per claim 6, Shao-Po discloses an objective (eq. 4.1- pg. 79) and a set of constraints (e.g. *constraint lyap, constraint equ* – ch. 4.2.2 pg. 84).

As per claim 7, Shao-Po discloses one or more mathematical expressions (e.g. ch. 4.1, pg. 79; Fig. 4.1 – pg. 87; Fig. 4.4, pg. 90) and inequality (e.g. *Lyapunov inequality* – ch. 4.4.1, pg. 86).

As per claim 8, Shao-Po discloses optimization variables (matrices, vector – ch. 4.2.3 – pg. 83- Note: matrix or structures used for the optimization process are optimization variables)

As per claim 9, Shao-Po discloses before converting determining that the mathematical expressions reduce to objective or inequality or equality (e.g. ch. 4.2.2-4.2.3 pg. 83-84); but does not specify reducing expressions into posynomial expressions or determining that such optimization problem is a geometric program. This limitation, however, would have been obvious in view of the rationale set forth in claim 5 using Hershenson's teachings.

As per claim 10, only Hershenson discloses that some expressions are not posynomial expressions (col. 7, line 56 to col. 8, line 27). In light of the rationale set forth in claim 5, it would have been obvious for one of ordinary skill in the art at the time the invention was made to implement the step of determining which expressions are not fit to be further converted into posynomial form as taught by Hershenson and apply such determination step to the problem solving using constraints-based optimization language by Shao-Po; because if the purpose is to convert complex functions constraints and parameters into posynomial forms, it is required to only focus on creating posynomial expressions and filter out non-posynomial expressions in order to conform to the geometric programming as suggested by Hershenson.

But neither Shao-Po nor Hershenson discloses reporting to a user which expressions cannot be reduced into a posynomial objective or equality/inequality. The implemention of user interface in computer-implemented hardware/software design or circuit emulation framework in order to allow user to author or specify requirements and receive feedback from constraints compatibility checking was a known concept in the programming art at the time the invention was made, especially when such design involve CAD tools as suggested by Hershenson (col. 1, 2) or *LMITool* by Shao-Po (e.g. ch. 4.1.4 - pg. 82). It would have been obvious for one of ordinary skill in the art at the time the invention was made to add to the combination of Hershenson/Shao-Po an user interface allowing the user to interact with the circuit design and algorithmic programming as suggested by Hershenson; as well as the reporting to the users to the effect that some expressions fail to be reduced into posynomial objective or equality/inequality as claimed above. The motivation is that this would allow the user to specify and learn upon the results of such requirement acceptance by the framework or optimization of parameters used in

implementing the functions of the circuitry, as applied by common known methodologies like HDL, Verilog-based hardware/software circuit designs.

As per claim 11, the reduction of simple monomial expressions into more posynomial has been taught and addressed in claim 5 (see Hershenson: col. 5, line 34 to col. 10, line 45-- Note: the monomial expressions representing signal mathematics in a circuitry used to be converted in more complex posynomial are mathematical expressions expressing signals, hence signomial); but Hershenson does not explicitly specifying canceling a combination of signomials. Official notice is taken that simplication of mathematical expressions prior to submitting them to more complex integrations was a known concept at the time the invention was made. Hence it would have been obvious for one of ordinary skill in the art at the time the invention was made to provide the simplification by canceling out signomial combinations in view of the in both optimization methods by Hershenson or Shao-Po, and apply such canceling to Hershenson's method as it enhances the optimization method by Shao-Po as set forth in claim 5 because simplifying a mathematical expression or in this case signomial combination is a must-do step in computation lest extraneous data complications and resources wasting down the later computing stages occur.

As per claim 12, Shao-Po discloses a computer-implemented method of parsing a mathematical optimization problem comprising:

reading a plurality of algebraic expressions that represent a mathematical problem, each algebraic expression in said plurality having one or more mathematical terms (e.g. *minimize* -, eq. 4.1, pg. 79; eq. 4.2 pg. 80; eq. 4.3 – pg. 81);

identifying a plurality of algebraic expressions or constraints form some complex mathematical terms using optimization structures (e.g. *inequality* - ch. 4.2.2 pg. 83; *matrix* – ch. 4.3.1 pg. 85);

converting said plurality of algebraic expressions to a optimized numeric format to be accepted by a computer-based program solver (e.g. *matrix* 4.14 – pg. 87; *spdsol* language & equ. 4.15 – pg. 89).

But Shao-Po does not specify identifying that the algebraic expressions form a geometric program; nor does Shao-Po specify that a computer-based program solver is a computer-aided geometric program solver. But the geometric program limitation has been addressed in claim 1 using Hershenson; hence the limitation as having a geometric program solver would have been obvious as addressed in claim 1. And since the limitation as to identifying that the algebraic expressions form a geometric program corresponds to the steps of identifying a geometric program as in claim 9; the above limitations would have been obvious using the same rationale as set forth in claim 9.

As per claims 13-15, refer to corresponding claims 6-8 for respective rejection.

As per claim 16, Shao-Po does not specify creating prior to identifying a set of signomial expressions by converting mathematical terms to a signomial; but this limitation has been addressed in claim 5 from above. Nor does Shao-Po disclose, after creating, determining if said signomials in said set reduce in posynomial objective or equality/inequality. But this limitation has been addressed by virtue of the rationale in claim 9.

As per claim 17, this limitation would have been obvious in view of the rationale as set in claim 5 and 9 from above.

As per claim 18, Shao-Po discloses a computer-readable medium for parsing a optimization program, comprising: an interface (*LMITool* – ch. 4.1.4, pg. 82) to accept a plurality of algebraic expressions that represent a optimization problem, each algebraic expression having one or more mathematical terms (e.g. *minimize* -, eq. 4.1, pg. 79; eq. 4.2 pg. 80; eq. 4.3 – pg. 81);

a verifier to identify that said algebraic expressions form a optimization constraint or optimization expression/objective (e.g. ch. 4.2.2 – pg. 83);

a matrix generator coupled to said verifier to convert said algebraic expressions to a compact numeric format for a computer-aided program solver (e.g. *matrix* 4.14 – pg. 87; *spdsol* language & equ. 4.15 – pg. 89).

But Shao-Po does not specify a verifier to identify that said algebraic expressions form a geometric program; nor accepting of a compact numeric format by a geometric program solver. But in view of the teachings by Hershenson from above, these limitations, i.e. steps of verifying and compacting into a geometric solver are rejected herein using the rationale as set forth in claims 1 and 9 as mentioned above.

As per claims 19-21, refer to claims 6-8, respectively.

As per claim 22, this claim corresponds to claim 11, hence is rejected with the same grounds as set forth therein.

Response to Arguments

4. Applicant's arguments filed 6/11/2004 have been fully considered but are not persuasive. With respect to the most representative points among arguments presented by Applicants, following are the Examiner's observation and response thereto.

(A) Applicants have submitted that "1) Shao-Po teaches parsing but does not … 2) Hershenson teaches geometric programming but … Examiner has effectively admitted that no suggestion … Shao-Po and Hershenson references" (Appl. Rmrks, pg. 9, middle para) and that "Examiner's own reasoning … declares that no such motivation exists" (Appl. Rmrks, pg. 9, last para). First, Examiner never admitted that there is no suggestion existing between the references for a combination to be feasible. The rejection clearly points out that both Shao-Po and Hershenson are solving complex problems implying mathematical expressions and that both apply complex situations where non-linear equations can be instantiated, i.e. inductive circuitry with exponential underlying in Hershenson and Shao-Po's suggestion of differential equation. Second, it was known in electrical engineering at the time of the invention that the inductive circuitry equation analysis most often requires the use of differential equations for capturing inductive function in conjunction with its exponential growth overtime; and this differential equating is also seen in the non-linear approach in Lyaponov's equation. Both Hershenson and Shao-Po use fundamental math tools to attempt to solve their problems, Hershenson suggesting CAD in the BACKGROUND and Shao-Po mentions about MatLab(ch. 4.2.1) and mathematical equations or algebraic expression are representation of the tool. It is the complexity of non-linear issues to solve, e.g. situations implicating differential equation approach, that is the factor that elicits the use of geometric programming, as disclosed in Hershenson's more endowed approach as solving complex non-linear problems. Since, Shao-Po attempts to solve non-linear complex situations with differential equation implication, Shao-Po's endeavor is further enhanced by Hershenson when Hershenson applies a better approach to handle those non-linear complex problems as given by Shao-Po via the use of geometric programming. Further, the

ground of the rejection is not set on the point that parsing is lacking in Hershenson and that Shao-Po has parsing; but only that Shao-Po does not specify that the optimization program is a geometric program; nor does Shao-Po disclose converting a set of algebraic expressions to a numeric format that can be accepted by a geometric program solver. From there, it is not believed that Examiner has conceded that there is no mutual suggestion in either reference enabling a reasonable combination. The rejection has established the reason why solving a complex problem as suggested by Shao-Po can be enhanced by Hershenson's approach using geometric programming. For the sake of argument, the limitation as to having a parser would be implicitly disclosed in the programming and optimization approach by Henderson. In all, the rejection has showed the similarity or a form of suggestion in the problem-solving or intended use by both references and put forth how some specific and complex problems as raised by Shao-Po can be furthered with using a geometric program of the likes of Hershenson's. In return, Applicants fail to show whether such combination would have generated adverse effects or destructed the mutual intentions set forth by Shao-Po or Hershenson. Thus, the rejection is considered proper, because one of ordinary skill in the art, presented with the suggested concepts extracted from the very references has been able to put together a working combination against which Applicants has not been able to point out any deficiencies.

(B) Concerning claim 5, Applicants have submitted that Hershenson does not disclose a signomial wherein some coefficients are allowed to be negative (Appl. Rmrks, pg. 11, top para). The claim never recites any coefficient being negative. Applicants have raised arguments on a feature that is not claimed; and this is improper.

(C) Applicants have submitted that Examiner has applied the rationale of claim 5 to reject claim 12 wherein there is no citing of "signomial expressions"(Appl. Rmrks, pg. 12, middle para). The rejection now points to the correct place where claim 12 can be referred to for similar rejection. The argument about the lack of suggestion (Appl. Rmrks, pg. 13, top) in Shao-Po and Hershenson has been addressed in section (A) from above.

(D) Concerning claim 18, the point raised (Appl. Rmrks, pg. 14, top) about a misdirected rationale falls under the ambit of section C above; hence is directed thereto for response. And concerning Applicants' point about lack of parsing in Hershenson and absence of geometric programming in Shao-Po (Appl. Rmrks, pg. 14, middle para) is again referred to section A for corresponding counter-argument.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tuan A Vu whose telephone number is (703)305-7207. The examiner can normally be reached on 8AM-4:30PM/Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kakali Chaki can be reached on (703)305-9662.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9306 (for formal communications intended for entry)

or: (703) 746-8734 (for informal or draft communications, please label "PROPOSED" or "DRAFT" – please consult Examiner before use)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington. VA. , 22202. 4th Floor(Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

VAT
August 29, 2004

KAKALI CHAKI
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100